## CLAIMS

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1) Apparatus for in-vivo determination of bio chemical concentrations comprising an optical illumination source and a detector, said detector characterized as including at least one pressure transducer having a geometric shape which results in a point within a test tissue being more strongly coupled than immediately surrounding points.

2) Apparatus of claim 1, said detector is further characterized as a directional microphone whereby a predetermined space is favored over other spatial regions with respect to transducer response and performance.

3) Apparatus of claim 2, said detector being arranged to address a portion of flesh contain interstitial fluids in human tissue.

4) Apparatus of claim 3, said bio chemical is a blood analyte.

5) Apparatus of claim 2, said detector is comprised of a plurality of transducers to form a multi-element detector array.

6) Apparatus of claim 5, said plurality of transducers are arranged in an axially symmetric pattern.

7) Apparatus of claim 6, said arrangement of transducers substantially forms an annulus.

8) Apparatus of claim 6, said arrangement of transducers a plurality of annuli at least one concentric with another.

9) Apparatus of claim 8, said detector includes electronic means of effecting a phase delay of signals generated at either of said transducers.

10) Apparatus of claim 8) said arrangement of transducers includes an optical port at the center.

11) Apparatus of claim 8, each ring is bifurcated into a plurality of wedge section sub-elements.

12) Apparatus of claim 11, detector includes electronic means of effecting a phase delay of signals generated at either of said sub-elements.

13) Methods of in-vivo determination of a bio chemical concentration by photoacoustic spectroscopy comprising the steps:

illuminating a tissue sample with middle infrared light;

receiving pressure waves emanating from illuminated tissue at a skin surface interface;

converting those pressure waves into electronic signals at a detector shaped such that energy emitted from a particular point is coupled to the transducer with a greater efficiency than other nearby points.

14) Methods of claim 13, said converting pressure waves into electronic signals step is done at a plurality of spatially removed locations.

15) Methods of claim 14, conversion of pressure waves is done simultaneously, thereafter a phase delay created electronically and introduced into at least one of the electronic signals.

16) Methods of 14, said converting pressure waves is done at a plurality of areas distributed about a symmetry axis.

17) Methods of claim 16, conversion of pressure waves is done simultaneously, thereafter a phase delay created electronically and introduced into at least one of the electronic signals.

18) Methods of claim 13, said steps include an intermediate step after receiving pressure waves at a skin surface comprising: reflecting said pressure waves from a shaped reflection surface whereby said pressure waves further propagate to a focus and become concentrated thereat.